

ECE 597/697DM — Post-CMOS Materials and Devices

Department of Electrical and Computer Engineering
University of Massachusetts at Amherst
Fall 2015

Day & Time: Mon/Wed/Fri 12:20 - 13:10

Place: Marston Hall room 211

Instructor: Prof. Jianhua (Joshua) Yang, (201G Marcus Hall, jjyang@umass.edu)

Office Hours: Wed 4:00-6:00 pm or by appointments

Course Description

Driven by the desire to continually advance the information technology, the world research community is aggressively searching for novel materials and devices beyond CMOS. This course will cover the fundamentals of materials and emerging electronic devices (e.g. Memristors and Spintronics) used as logic, memory, storage, sensor and display. Recent progress, current challenges and future directions will also be reviewed and discussed.

The course is intended to be self-contained by covering both materials and devices.

Course Goals

- To introduce basic materials science knowledge: thermodynamics, kinetics, properties, and characterizations.
- To introduce emerging electronic and ionic devices: mechanisms, structure, promises, and challenges.
- To utilize learned materials principles in understanding and designing novel devices.

Lecture Topics:

- Materials basics (structure, defects, classifications, bonds etc.)
 - Electronic properties of materials (electrical, magnetic etc.)
 - Thermodynamics and applications
 - Kinetics and applications
 - Thin films deposition and growth
 - Materials characterization techniques
 - Emerging Memory devices
 - Emerging Logic devices
 - Other emerging devices
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Course Materials

Lectures and lecture notes are the primary course materials.

Recommended Text

- Materials Science and Engineering: An Introduction, by William D. Callister and David G. Rethwisch, Wiley, 2013, 9rd Ed.
- Materials Science Of Thin Films, by Milton Ohring, Academic Press, 2002. 2nd Ed.
- Electronic Properties of Materials, by Rolf E. Hummel, Springer, 2001, 3rd Ed.

Useful Reference Texts

- Materials Thermodynamics, by Y. Austin Chang and W. Alan Oates, Wiley, 2010.
 - Nanoelectronics and Information Technology, by Rainer Waser, Wiley-VCH, 2012, 3rd Ed.
 - Physics of Semiconductor Devices, by Simon. M. Sze, Wiley, 2006, 3rd Ed.
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Grading

Homework - 10%

Midterm Exam - 30%

Final Exam - 30%

Course Project – 30%
